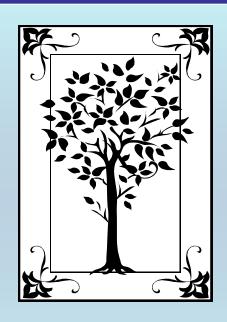
# METADATA AND NUMERICAL DATA CAPTURE: Uncertainties (General Description)

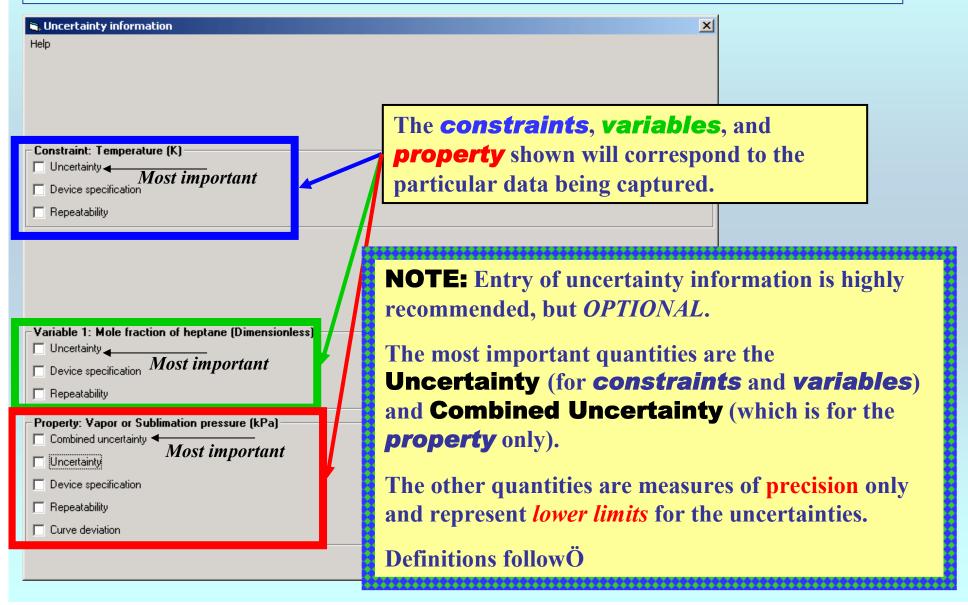
Guided Data
Capture (GDC)



This tutorial describes
DATA CAPTURE:

for **Uncertainties** and **Precisions** with the Guided Data Capture (GDC) software.

**NOTE:** In GDC 3.0 all *uncertainty* and *precision* information is captured on one form, as shown below. The form appears after the property and metadata (phases, constraints, etc.) are specified.



Constraint: Temperature (K)	
Uncertainty	— Most important
Device specification	
☐ Repeatability	

3 General measures of uncertainty/precision are shown for each constraint, variable, and property.

The **property** has two additional quantities described later.

You can select to enter any or all of these. Additional fields assoicated with the quantity appear after selection. (Select by checking the *check box*)

The following pages show each uncertainty/precision type.

┌Variable 1: Mole fraction of heptane (Dimensionless)					
✓ Uncertainty	Value:		Level of confidence:	95	%
Device specification					_
Repeatability					

**Uncertainty** is the most important quantity for **variables** and **constraints**. This quantity is the **Expanded Uncertainty** described in *J. Chem. Eng. Data*, 2003, 48, 1344.

It includes the uncertainty arising from all sources, but does not include propagation of uncertainty from other constraints or variables.

The **value** for the *entire data set* can be entered as an *absolute value* or *percentage*. (Select the % check box for percentages)

If necessary, *Uncertainties* associated with *individual data points* can be entered in the *Data Table Form* which follows the *Uncertainty Info Form*.

Variable 1: Mole fraction	of heptane (Dimensionless)			
☐ Uncertainty				
Device specification	Value: 2 % Level of confidence	: 95 % 1	Evaluator: Manufacturer	▼
☐ Repeatability				

# **Device Specification** is a type of precision.

**Device specification** allows reporting of device calibration information. This does not include uncertainties associated with use of the device in the experimental apparatus.

For example, a thermometer could have a *Device Specification* value of 0.01 K (based on calibration), but the uncertainty in the temperature measurements might be much larger.

The *Device Specification* value is one measure of the *lower limit* for the uncertainty.

Variable 1: Mole fraction	of methyl tert-butyl ether (Dimensionless)	
☐ Uncertainty		
Device specification		
▼ Repeatability	Value: Standard Deviation of a Single Measurement	Repetitions:

# **Repeatability** is another type of precision.

#### Repeatability is defined as:

Closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement.

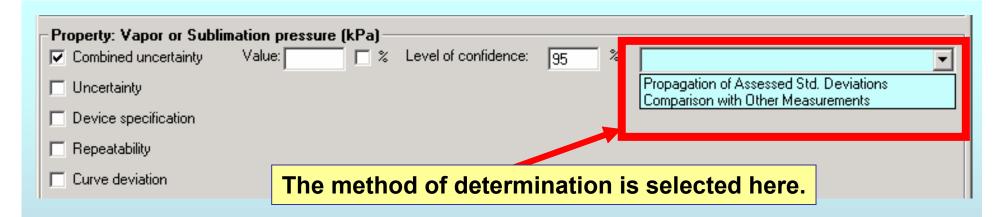
Repeatability is expressed in GDC as: the *Standard Deviation of a Single Measurement* or the *Standard Deviation of the Mean*. (Mathematical formulations are given in the HELP file for the **Uncertainty Information** form.

The Repeatability value is another measure of the lower limit for the uncertainty.

Property: Vapor or Sublimation pressure (kPa)  Combined uncertainty
☐ Uncertainty
Device specification
Repeatability
Curve deviation

### **The PROPERTY has 2 additional representations:**

- 1) Combined Uncertainty: This is like the *Uncertainty*, but it includes uncertainty *propagated* from the variables and constraints. This is the most important representation of uncertainty.
- **2) Curve deviation**: This is another measure of the *lower limit* for the uncertainty



**Combined Uncertainty** is the most important quantity for properties. This is the *Combined Expanded Uncertainty* described in *J. Chem. Eng. Data*, 2003, 48, 1344.

This quantity includes the uncertainty arising from all sources, and includes propagation of uncertainty from the constraints or variables.

The quantity can be entered as an absolute value or percentage.

You should select how the values were determined from the indicated pull-down menu. (shown in the red box above)

Property: Vapor or Sublimation pressure (kPa)  Combined uncertainty		
The equation type or name can be	antarad hara as taxt	
Device specification	entered nere as text.	
☐ Repeatability		
✓ Curve deviation   RMS:     □ %   Equation type:		

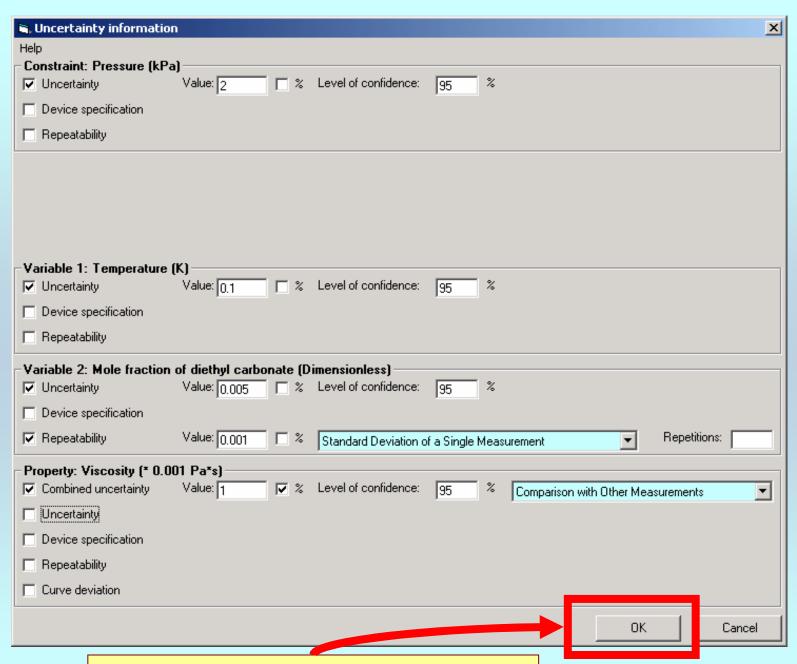
**Curve deviation** is another type of precision.

#### Curve deviation is defined as:

The root-mean-square deviation from a specified curve.

The *Curve deviation* value is another measure of the *lower limit* for the uncertainty.

The value can be expressed as an absolute value or percentage.



Click **OK**, when the form is complete.

#### All definitions are based on the following documents:

Definitions and descriptions of all quantities related to the expression of uncertainty in GDC conform to the;

Guide to the Expression of Uncertainty in Measurement, ISO (International Organization for Standardization), October, 1993.

These ISO recommendations were adopted with minor editorial changes as the;

U.S. Guide to the Expression of Uncertainty in Measurement. (commonly referred to by its abbreviation; the GUM).

The recommendations have been summarized in;

Guidelines for the Evaluation and Expression of Uncertainty in NIST

Measurement Results

This final document is available via free download from the Internet (http://physics.nist.gov/cuu/).

A more complete discussion of the uncertainty terms used here is given in *J. Chem. Eng. Data*, **2003**, <u>48</u>, 1344-1359.

Note: This article provides much more detail than is necessary for use of GDC.

# **END**

Continue with data capture...